3/1/18 "I make the most of all that comes and the least of all that goes."-Sara Teasdale

HW: "Related Rates" packet page #4, 6
Test 2 on Wednesday 3/7

AIM: How do we solve problems using Related Rates?

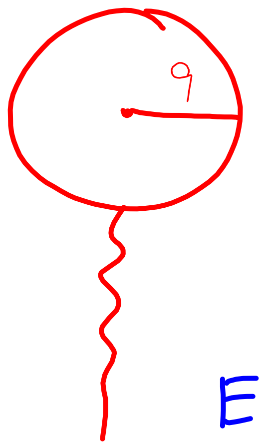
Do Now: **Find the derivative of the following equation with respect to t, (d/dt) if v, r and h are variables**

$$V = \pi r^2 h$$

$$\frac{dV}{dt} = 2\pi r \frac{dr}{dt} h + \pi r^2 \frac{dh}{dt}$$

HW Check:

#2



Have:

$r = 9\text{cm}$

$\frac{dr}{dt} = -15 \text{cm/min}$

Need:

$\frac{dV}{dt}$

Equation: $V = \frac{4}{3}\pi r^3$

$$\frac{dV}{dt} = 4\pi r^2 \frac{dr}{dt}$$

$$\frac{dV}{dt} = 4\pi(9)^2(-15)$$

$$\frac{dV}{dt} = -4860\pi \ \text{cm}^3/\text{min}$$

Air being removed @ $4860\pi \ \text{cm}^3/\text{min}$

General

The power P (watts) of an electric circuit is related to the circuit's resistance R (ohms) and current I (amperes) by the equation $P = I^2R$.
Given: R=5 ohms, P=45 watts, I is *decreasing* at $\frac{1}{3}$ $amps/sec$, R is *increasing* at 2 $ohms/sec$
find $\frac{dP}{dt}$.

① Given:

R = 5 ohms

P = 45 watts

$\frac{dI}{dt} = -\frac{1}{3}\ \frac{amps}{sec}$

$\frac{dR}{dt} = 2\ \frac{ohm}{sec}$

② Looking for:

$\frac{dP}{dt}$

③ Equation:

$P = I^2 R$

④ Derivative:

$\frac{dP}{dt} = 2I\frac{dI}{dt}r + \frac{dr}{dt}I^2$

⑤ $P = I^2 R$

$45 = I^2(5)$

$9 = I^2$

$3 = I$

⑥ Solve:

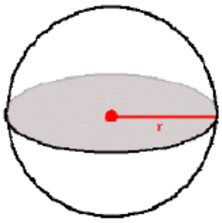
$\frac{dP}{dt} = 2(3)(-\frac{1}{3})(5) + (2)(3)^2$

$\boxed{\frac{dP}{dt} = 8\ \frac{watts}{sec}}$

Circle

When a circular shield of bronze is heated over a fire its radius increases at the rate of $\frac{1}{5}$ cm/sec. At what rate is the shields area increasing when the radius is 50 cm?

Sphere

	The **volume** of a sphere is given by the equation: $$V = \frac{4}{3}\pi r^3$$	The **surface area** of a sphere is given by the equation: $$S = 4\pi r^2$$

Question: A spherical snowball with an outer layer of ice melts so that the *volume* of the snowball decreases at a rate of 2 cm^3/min.

(a) How *fast is the radius changing* when diameter of the snowball is 10 cm?

(b) How fast is **surface area** of the snowball *decreasing* at this time?